were recorded at all the other five French observatories and in general they were larger than ever before recorded. In England, at Kew, the disturbance of the declination was about 2° 12′ and at Stonyhurst 2° 46′ as compared with 2° 4′ at Val-Joyeux in France.

Sun spots had been observed in October, but there did not appear to be any direct connection between them and the magnetic disturbances; thus, on the 5th of November a new group of spots crossed the central meridian of the sun without any disturbance of the very regular magnetic curves of that day.

It seems, as has been shown by Tacchini, that the magnetic pertubations are less dependent upon the heliocentric longitude of the spots than on the rapid variations in their forms, variations to which they are not all subjected, but of which we can take account, either by direct observation or by a series of photographs. It is necessary moreover to observe not only the spots, but all manifestations of solar activity, that is to say protuberances and faculæ. In the course of the disturbance, the earth currents as observed on telegraph wires and cables attained an intensity much greater than the battery currents ordinarily used in telegraphy: consequently there were serious troubles in the transmission of messages and total interruptions sometimes occurred in both America and Europe. In France communication became impossible about 9 a. m., October 31, and could only be resumed at 4:40 p. m.

The aurora borealis was observed in the United States on the morning of the 31st, and in Ireland and Scotland on the evening of that day. No trace of the aurora was observed in France. A beautiful aurora was observed at Sydney, N. S. W. during the night of October 31–November 1.

The reports from vessels at sea are given elsewhere in a letter from Mr. James Page, of the United States Hydrographic Office, as also a report from the magnetic observatory at Zi-Ka-Wei.

From Table IV, page 496, of the October REVIEW, and page 558 of the November REVIEW, we copy the total number of United States stations reporting thunderstorms and auroras, as follows:

Date.	Thunderstorms.	Auroras.
October 27	5	1
October 28	11	1
October 29	13	2
October 30	71	19
October 31	89	139
November 1	83	18
November 2	38	6
November 3	47	2

STORMS ON THE SOUTHEAST COAST OF CAPE COLONY.

During the early morning of September 13, 1902, a violent storm suddenly struck the southeast coast of Cape Colony and caused great destruction of shipping and life along the shore of Algoa Bay, which is about 400 miles east of Cape Town. The beach facing Port Elizabeth was strewn with the wreckage of 29 sailing vessels and the bodies of over 100 sailors. The storm came absolutely without warning. There were 32 ships at anchor in the harbor under a leaden sky when the approach of a huge wave from the open sea gave the first warning of what was coming.

The study of the storms of south Africa by means of carefully compiled charts of the weather was, we believe, first prosecuted by Mr. Adolph G. Howard, of Cape Town, during 1885–1890. Others had compiled observations at individual localities, but to him is due the credit of preparing a systematic series of daily maps from January, 1885, to December, 1889, showing isobars and winds and the prevailing characteristics of the weather for the region between latitudes 25° and 33° south. These unpublished charts showed him the movements of storms, coming sometimes from the east and sometimes from the west, according to the season. The variations were very much the same as those experienced on our own coasts from South Carolina to Texas. The charts that are now being published daily for Argentina show similar variations in the paths of storms. Similar variations occur in the neighborhood of Australia, all of which merely goes to show that between latitude 20° and 40° in the Southern Hemisphere we have phenomena entirely analogous to those that occur between 20° and 50° in the Northern Hemisphere, so far as concerns the paths of revolving storm centers. On the other hand, we have in the Southern Hemisphere only the feeblest possible Antarctic cold waves, as compared with the very severe Arctic cold waves in the Northern Hemisphere. These latter flow from the Arctic Circle southward to latitude 25° in America, but scarcely as far as latitude 30° in Europe and Asia, while in the Southern Hemisphere they are only feebly represented by the southerly bursters of Australia and the southwest winds of Patagonia and Argentina. The southern point of Africa, Cape Agulhas, is too far from the Antarctic Continent and too well protected by ocean water to be ever reached by a wave colder than those that reach the equally well protected islands of the North Atlantic, such as the Bermudas and the Azores, which are in almost the same latitude north. Storm centers may approach the southern end of Africa from the southeast when the tropical area of high pressure to the eastward is unusually well developed or when the southeast monsoon is unusually strong. Storms may approach from the northwest when the tropical high pressure over the South Atlantic is unusually strong. Storms come down from the north when the interior of Africa is unusually dry and cool, so that it is brought under the influence of the South Atlantic area of high pressure.

DENSITY OF THE ATMOSPHERE UNDER DIFFERENT CONDITIONS.

A correspondent asks the Weather Bureau to make some experimental determination of the density of the air within areas of low pressure, as compared with the density within areas of high pressure. He also asks whether moist air has not a greater specific gravity than dry air, and if moist air under low pressure is heavier than dry air under high pressure.

It is a common idiom to speak of "a heavy atmosphere" when smoke settles down to the ground, or when heavy clouds form low down and threaten to rain; so also we speak of "dull and heavy weather" when we are conscious of a feeling of oppression. This is a poetic usage of the word heavy, in which we attribute to the atmosphere something that really belongs to ourselves. When the smoke falls or the clouds drop rain, it is not the air that is heavy, but the thing that falls. If we experience an oppressive feeling, it is our nervous system that is slightly deranged; the oppression is not a matter of weight or of meteorology, but is a complex physiological phenomenon.

The density of the atmosphere, or its specific gravity, or the weight of a cubic foot of air, increases in proportion as the barometric pressure is greater, and in proportion as the air is drier or free from moisture, assuming that the air remains at the same temperature. Consequently there can be no doubt but that the atmosphere in a region of low pressure and damp air has a smaller specific gravity than in a region of high pressure and dry air. It is not necessary for the Weather Bureau to make any special test of this subject, as its truth is manifest from the experiments made frequently in physical laboratories, in order to determine the properties of gases.

WEATHER NOTES AT WEST CUMMINGTON, MASS.

Mr. William G. Atkins, of West Cummington, Mass., writes, as follows:

Referring to my diary and weather records, which cover a period of forty-five years, I find that the snowfall which gave the most equivalent water occurred on April 20 and 21, 1857, when over 3 feet of heavy wet snow fell on the ground that was previously bare.

1861. February 7 was rainy and snowy; a violent snow squall came about 4 p. m. with a sudden fall in temperature. At 9 p. m. the mercury was at 0° F. and the next morning at 32° below, being a total fall of about 80°. It was 17° below at noon on the 8th of February. On one morning near that date the mercury registered 20° below, but at noon it was 30° above, or a rise of 50° in five hours.

1875. November 30, the mercury remained below zero all day, the only such record occurring during forty-five years, and, according to Reuben Pierce's "Annals of the Weather," it was the only such record for November for eighty years past.

1880. June 25, the mercury registered 100°.

During the year 1894, three conditions of the weather were recorded, unparalled during the forty-five years.

a. March was very mild and open, scarcely any freezing weather during the first three weeks.

b. The drought of mid-summer was the most severe on record.

c. There was a week of good sleighing during the first half of November.

My record of snowfall shows that the average per winter on the hills in this neighborhood was nearly 8 feet. The winter of 1856–57 gave nearly 12 feet, while the winter of 1899–1900 gave 42 inches. The latter is the smallest on my record, the next larger was 4 feet 2 inches in 1857–58. The winter of 1898–99 gave 141 days of continuous sleighing. The winter of 1899–1900 gave the largest number of days of icy and slippery traveling. The snow blizzard of March 12–14, 1888, the dark day of September 6, 1881, and the extensive disastrous flood of October 4, 1869, are all indelibly impressed upon the mind. During the winter of 1868–69, the lowest extremes of temperature occurred in December and in March.

August is generally a hot, dry month, but in August, 1856, two freshets occurred, caused by heavy rainfalls.

I have seen frosts every month in the year, and killing frosts every month except July.

In the face of these climatic changes we are told that the West and South present much more severe and sudden changes than the climate of New England.

INTERNATIONAL SEISMOLOGICAL ASSOCIATION.

Up to the present time the MONTHLY WEATHER REVIEW has published items bearing on earthquakes, partly because of the general interest in this subject and because of the good records kept by meteorological observers, partly also because we have no journal especially devoted to this subject. At the recent International Conference at Strassburg, Prof. H. F. Reid, of Johns Hopkins University, was present as the official delegate from the United States, and more especially from the United States Geological Survey. He reports that the conference decided upon a form of organization for an international seismological association. The principal features of this association will be the formation of a central bureau for the collection, study, and publication of the reports sent from various countries, and the establishment of local bureaus and local seismological observatories in all parts of the world. A general assembly of delegates will meet at least once in four years. The expenses of the association will be met by contributions from each cooperating nation. A general report as to the instruments best adapted for recording earthquakes will be prepared, but meanwhile each observatory will select its own. It was unanimously decided that in describing earthquakes, and especially in the published official reports of the association, Greenwich mean civil time should be used. Those who are interested in this subject should correspond directly, either with Prof. Harry Fielding Reid of the Johns Hopkins University, Baltimore, Md., or with Professor Dr. Gerland, Director of the Central Seismological Station, Strassburg, Germany.

METEOROLOGY IN HAWAII.

The Governor of the Territory of Hawaii, Hon. G. R. Carter, under date of December 12, 1903, announces that—

> The revenues of the territory have been reduced more than one-half, and it will be practically impossible to continue the maintenance of the meteorological service. Much as we should like to prevent a break in the records, yet absolute necessity will force us to discontinue the service. Economy must be practised in every department, and we can not continue the salary even of Mr. Lydecker as territorial meteorologist.

In reply to this communication, the Secretary of Agriculture has written as follows:

> In answer to your letter of December 12, 1903, I have the honor to say that my estimates for the support of the Weather Service for the fiscal year beginning July 1, next, provide a sufficient sum to enable us to establish in the Hawaiian Islands a section of the Climate and Crop Service of the Weather Bureau. I am of the opinion that favorable action on these estimates will be taken by Congress. If so, immediately after the first of July next, an official from the Weather Bureau, with an assistant, will be sent to open an observatory at Honolulu. I shall then be glad to have such apparatus as you possess turned over to our representative, which I understand from your communication it is your desire to do. I am of the opinion that a weekly report of the condition of crops should be made and published, the same as is done for each one of our States, and that a monthly publication should be made on the climate of the islands. All this will be undertaken as soon as the means are put at our command.

Notwithstanding the foregoing it is hoped that the Hawaiian government may be able to keep up the meteorological records until the United States Government can relieve it of the work, probably next July. The surveyor general of Hawaii, Mr. E. Wall, is compiling a series of large maps of the archipelago, showing especially the location and elevations of the meteorological stations and other points of scientific interest.

INFLUENCE OF CONTINENTS AND OCEANS ON THE ATMOSPHERE.

In connection with his article in the MONTHLY WEATHER REVIEW, December, 1901, on the physical basis of long-range forecasting, the Editor has been asked how one can express in mathematical language, either analytical or graphic, the character of the different influences exerted on the atmosphere by the land and water, especially the land and water hemispheres there spoken of. Now it is evident that the action of the land differs from that of the ocean in three general respects: thermal, hygrometric, and mechanical, and the following points are to be considered:

1. The atmosphere above the land has a temperature by day higher than that above the water, and the laws expressing this are given in Professor Ferrel's Professional Paper of the Signal Service, No. 13, "Temperature of the Atmosphere and the Earth's Surface."

2. The atmosphere receives far more moisture from the ocean than from the land and the forests on the land, and even more than it does from the snow and ice that cover a portion of the land.

3. This superior content of moisture implies also higher specific heat and a vastly higher content of latent heat, all of which affects its subsequent behavior and phenomena.

4. The movement of the atmosphere over the land with its very irregular surface, is retarded far more than is its movement over the ocean. Even if the land be a smooth plain, a special form of increased resistence is introduced by the fact that during the daytime the heated air rises with a sluggish horizontal movement, and is replaced by descending air having more rapid horizontal movement. This sluggish air is, therefore, an obstacle to the rapidly moving air, not only near the ground, but also at the upper heights to which it rises. There is, therefore, a diurnal periodicity in the horizontal movement of the atmosphere; the latter is at low levels greatest in the middle of the day, but at high levels greatest in the night time. In the process of pushing sluggish air forward the rapidly moving currents convert a part of their kinetic energy into static pressure, and this gives rise to some of the terms in the so-called diurnal oscillation of the barometer. In general, as the air is slightly viscous, we represent the force required for an upper layer to slide over a lower layer by the term for viscosity introduced into the ordinary hydrodynamic equations, whose coefficient is μ (see p. 558, MONTHLY WEATHER REVIEW, December, 1901). Strictly speaking, viscosity is of slight importance, but if we consider the coefficient μ to be itself the summation of several terms, representing, respectively, (*a*) viscosity; (*b*) retardation due to vertical movements caused by orography, producing a mixture of swift upper with slower lower currents; (*c*) retardation due to vertical movements caused by local differences of temperature, producing the same mixture as in *b*; (*d*) retardation due to local differences of moisture; (*e*) that due to local falling rain (since that also is a mass that